U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Geranium hanaense*

COMMON NAME: Nohoanu

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: August 2005

STATUS/ACTION:

___ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

___ New candidate

_X__ Continuing candidate

___ Non-petitioned

_X__ Petitioned - Date petition received: May 11, 2004

__ 90-day positive - FR date:

_X_ 12-month warranted but precluded - FR date: May 11, 2005

_N_ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions. During the past 12 months, most of our national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (http://endangered.fws.gov).

_X__ Listing priority change

Former LP: _2__

New LP: _5__

Date when the species first became a Candidate (as currently defined): 1999

___ Candidate removal: Former LP: __

___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or

continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F – Range is no longer a U.S. territory.

___ I – Insufficient information exists on biological vulnerability and threats to support listing.

___ M – Taxon mistakenly included in past notice of review.

___ N – Taxon does not meet the Act's definition of "species."

___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Geraniaceae (Geranium family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Maui

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Maui

LAND OWNERSHIP: *Geranium hanaense* occurs on Federal (Haleakala National Park) lands.

LEAD REGION CONTACT: Paul Phifer, 503-872-2823, paul_phifer@fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, 808-792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION:

Species Description *Geranium hanaense* is a decumbent shrub 0.3 to 0.5 meters (1 to 1.6 feet (ft)) tall, stems are dark reddish brown, often rooting at the nodes, sparingly branched, and leafy only toward the apex. Leaves are alternate, oblong-obovate to oblong-elliptic, 1.5 to 5 centimeters (cm) (0.6 to 2 inches (in)) long, 0.8 to 2 cm (0.3 to 0.8 in) wide, with the upper and lower surfaces densely silky strigose. Flowers are three to six in compound cymes. Petals are white and streaked with purple or purplish magenta. Seeds are presumably one per cell (Wagner *et al*. 1999a).

Taxonomy *Geranium hanaense* was described by A.C. Medeiros and St. John (1988). This species is recognized as a distinct taxon in Wagner *et al*. (1999a) and Wagner and Herbst (2003), the most recently accepted Hawaiian plant taxonomy.

Habitat *Geranium hanaense* forms large patches in bogs at elevations between 1,670 and 1,680 m (5,479 and 5,512 ft) (Wagner *et al*.1999a).

Historical and Current Range/Current Status First described in 1988, *Geranium hanaense* was known from only two adjacent montane bogs on the northeast outer rift of Haleakala, east Maui. At that time the species was represented by 500 to 700 individuals (Medeiros and St. John 1988). Since then, the species has declined significantly (Robert Hobdy, Hawaii Division of Forestry

and Wildlife, pers. comm. 1996), and currently only 300 to 500 individuals remain (Ken Wood, National Tropical Botanical Garden, pers. comm. 2005).

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range.
This species is threatened by feral pigs (*Sus scrofa*) that degrade and destroy habitat (Medeiros and St. John 1988; R. Hobdy, pers. comm. 1996). As early as 1778, European explorers introduced livestock, which became feral, increased in number and range, and caused significant changes to the natural environment of Hawaii. Past and present activities of introduced alien mammals are the primary factor altering and degrading vegetation and habitat on Maui. Pigs are currently present on Maui and four other islands, and inhabit rain forests and grasslands. While rooting in the ground in search of the invertebrates and plant material they eat, feral pigs disturb and destroy vegetative cover, trample plants and seedlings, and threaten forest regeneration by damaging seeds and seedlings. They disturb soil and cause erosion, especially on slopes. Alien plant seeds are dispersed on their hooves and coats as well as through their digestive tracts, and the disturbed soil is fertilized by their feces, helping these plants to establish. Pigs are a major vector in the spread of many introduced plant species. Feral ungulates trample and eat native vegetation and disturb and open areas. This causes erosion and allows the entry of alien plant species (Cuddihy and Stone 1990; Wagner *et al*. 1999a). Pigs have been fenced out of the populations where this taxon currently occurs; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas.

B. Overutilization for commercial, recreational, scientific, or educational purposes.
None known.

C. Disease or predation.
Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Carlquist 1980, Lamoureux 1994). Browsing by ungulates has been observed on many other native species, including common and rare or endangered species (Cuddihy and Stone 1990; Loope *et al*. 1991). Therefore, even though there are no observations of browsing for this species, it is likely that pigs impact this species directly as well as their indirect impacts to the surrounding habitat. Pigs have been fenced out of the populations where this taxon currently occurs; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas.

D. The inadequacy of existing regulatory mechanisms.
None known.

E. Other natural or manmade factors affecting its continued existence.
Alien plant species threaten this species (Medeiros and St. John 1988; R. Hobdy, pers. comm. 1996). Although the exact pest species that threaten this plant have not been identified, alien pest plants are found throughout the areas where this species occurs. The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent were introduced from other parts of the world, and nearly 100 species have become pests (Smith 1985; Wagner *et al*. 1999a).

Confirmed personal observations (Medeiros and St. John 1988; R. Hobdy, pers. comm. 1996) and several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al*. 1998) indicate nonnative plant species may outcompete native plants similar to *Geranium hanaense*. Competition may be for space, light, water, or nutrients, or there may be a chemical inhibition of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al.* 1992; Ellshoff *et al.* 1995; Meyer and Florence 1996; Medeiros *et al.* 1997; Loope *et al*. 2004). In particular, alien pest plant species modify habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al*. 1987). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to the bog habitat of *G. hanaense*, the Service believes nonnative plant species are a threat to *G. hanaense*. The nonnative plants are being controlled within all known populations, but will probably never be completely eradicated because new propagules are constantly being dispersed into the fenced area from surrounding, unmanaged lands. Currently, many widespread alien plant taxa cannot be completely eradicated from Maui, and therefore are expected to continue dispersing into previously managed areas (Loope 1998, Smith 1985).

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

Geranium hanaense is protected by National Park Service regulations and policy for native plant species within park boundaries. The Park Service has fenced the two bogs where *Geranium hanaense* occurs and is implementing nonnative plant species control in the fenced areas (Hawaii Natural Heritage Program database 2004).

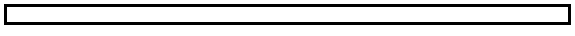
SUMMARY OF THREATS:

The major threats to this species include feral pigs and nonnative plants. Feral pigs have been fenced out all populations where this taxon currently occurs, but the fences must be continually maintained to prevent incursion. Nonnative plants have been reduced in all fenced areas. This species is not recovering and continues to decline, even though the major known threats are being controlled.

SUMMARY OF REASONS FOR ADDITION, REMOVAL OR LISTING PRIORITY CHANGE:

The listing priority number is being changed from 2 to 5 because both bog areas in which all individuals of this species are currently found are fenced, feral pigs have been removed, and nonnative plant control is being implemented within the fenced areas. Therefore, the threats of habitat degradation and destruction, and dispersal of nonnative plants from feral pigs, and competition with nonnative plants are non-imminent since they are not currently occurring. In order to prevent future incursion of the fenced areas by feral pigs, the fences must be continually surveyed and maintained. Should the integrity of the fences be compromised or control of nonnative plants cease, the LPN for *Geranium hanaense* will be reevaluated.

LISTING PRIORITY:



THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	**5***
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude:
This species is highly threatened by pigs that degrade and destroy habitat, and by nonnative plants that outcompete and displace it. Threats to montane bog habitat of *Geranium hanaense* and to individuals of this species occur throughout its range, and are expected to continue or increase without control or eradication. Feral pigs have been fenced out of the bogs in which this species currently occurs, but the fences must be continually maintained to prevent incursion. Nonnative plants have been reduced in all fenced areas. This species has declined since it was first described in 1988.

Imminence:
Threats to *Geranium hanaense* from pigs and nonnative plants are non-imminent because the bogs in which all individuals of this species are currently found are fenced and nonnative plant control is underway within the fenced areas. However, in order to prevent future incursion of the fenced areas by feral pigs, the fences must be continually maintained. Should the integrity of the fences be compromised or control of nonnative plants cease, the LPN for *Geranium hanaense* will be reevaluated.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. In addition, feral pigs have been fenced out of the bogs in which this species currently occurs and control of nonnative plants is ongoing in the fenced areas. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction,

then the emergency rule process for this species will be initiated. We will continue to monitor the status of *Geranium hanaense* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING:
Much of the information in this form is based on the results of a meeting of 20 botanical experts held by the Center for Plant Conservation in December of 1995, and was updated by personal communication with Robert Hobdy of the Hawaii Division of Forestry and Wildlife in 1996. We have incorporated additional information on this species from our files and the most recent supplement to the *Manual of the Flowering Plants of Hawaii* (Wagner and Herbst 2003). In 2004, the Pacific Islands office contacted the following species experts: Bob Hobdy, retired from Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Natural Heritage Program; Art Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. No new information on status or range was provided in 2004. In 2005 we contacted the species experts listed below and confirmation of the status of *Gernaium hanaense* was provided by Ken Wood, National Tropical Botanical Garden.

One species expert provided new information confirming the status of the species this year and the results are included in this assessment.

COORDINATION WITH STATES:
In October 2004 we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. Vickie Caraway, the State botanist, reviewed the information for this species and provided no additional information or corrections (V. Caraway, pers. comm. 2005).

LITERATURE CITED and other REFERENCES:

List all experts contacted:

Name	Date	Place of Employment
1. Joel Lau	June 28, 2005	Hawaii Natural Heritage Program
2. Art Medeiros	June 28, 2005	U.S.G.S. Biological Resources Discipline
3. Jim Jacobi	June 28, 2005	U.S.G.S. Biological Resources Discipline
4. Rick Warshauer	June 28, 2005	U.S.G.S. Biological Resources Discipline
5. Hank Oppenheimer	June 28, 2005	Maui Land and Pineapple Company
6. Kapua Kawelo	June 28, 2005	U.S. Army
7. Dave Lorence	June 28, 2005	National Tropical Botanical Garden
8. Steve Perlman	March 29, 2005	National Tropical Botanical Garden
9. Ken Wood *	August 2, 2005	National Tropical Botanical Garden
10. Marie Bruegmann	July 13, 2005	U.S. Fish and Wildlife Service
11. Vickie Caraway	June 14, 2005	Hawaii Division of Forestry and Wildlife

*Provided new information on this taxon in 2005

List all databases searched:

Name	Date
1. Hawaii Natural Heritage Program	2004

Other resources utilized:

Carlquist, S. 1980. Hawaii: A natural history, 2nd edition. Pacific Tropical Botanical Garden, Honolulu. 468 pp.

Center for Biological Diversity, Dr. Jane Goodall, Dr. E.O. Wilson, Dr. Paul Ehrlich, Dr. John Terborgh, Dr. Niles Eldridge, Dr. Thomas Eisner, Dr. Robert Hass, Barbara Kingsolver, Charles Bowden, Martin Sheen, the Xerces Society, and the Biodiversity Conservation Alliance. 2004. Hawaiian Plants: petitions to list as federally endangered species. May 4, 2004.

Cuddihy, L.W., and C.P. Stone. 1990. Alteration of native Hawaiian vegetation; effects of humans, their activities and introductions. Coop. Natl. Park Resources Stud. Unit, Hawaii. 138 pp.

Ellshoff, Z.E., D.E. Gardner, C. Wikler, and C.W. Smith. 1995. Annotated bibliography of the genus *Psidium*, with emphasis on *P. cattleianum* (strawberry guava) and *P. guajava* (common guava), forest weeds in Hawai`i. Cooperative National Park Resources Studies Unit, University of Hawaii. Technical Report 95.

Hawaii, Department of Land and Natural Resources. N.d.-a. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Oahu. Division of Forestry and Wildlife, Honolulu. 2 pp.

Hawaii, Department of Land and Natural Resources. N.d.-b. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Molokai. Division of Forestry and Wildlife, Honolulu. 2 pp.

Hawaii, Department of Land and Natural Resources. N.d.-c. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Maui. Division of Forestry and Wildlife, Honolulu. 2 pp.

Lamoureux, C.H. 1994. Conserving Hawaiian biodiversity – the role of Hawaiian botanical gardens. Pp. 55-57. In: C.-I Peng and C.H. Chou (eds.). Biodiversity and Terrestrial Ecosystems. Institute of Botany, Academia Sinica Monograph Series No. 14.

Loope, L.L., A.C. Medeiros, and B.H. Gagné. 1991. Recovery of Vegetation of a montane bog following protection from feral pig rooting. Coop. Natl. Park Resources Studies Unit, Univ. Hawaii/Manoa, Dept. Of Botany, Tech. Rept. 77.

Loope, L.L. and A.C. Medeiros. 1992. A new and invasive grass on Maui. Newsletter of the Hawaiian Botanical Society 31: 7-8.

Loope, L.L. 1998. Hawaii and Pacific Islands. Pp. 747-774. In: M.J. Mac, P.A. Opler, C.E. Puckett Haecker, and P.D. Doran (eds.). Status and Trends of the Nation's Biological Resources, Volume 2. U.S. Department of the Interior, U.S. Geological Survey, Reston, VA.

Loope, L., F. Starr and K. Starr. 2004. Management and research for protecting endangered Hawaiian plant species from displacement by invasive plants on Maui, Hawaii. Weed Technology 18: 1472-1474.

Medeiros, A.C., L.L. Loope, P. Conant and S. McElvaney. 1997. Status, ecology, and management of the invasive plant, *Miconia calvescens* DC (Melastomataceae) in the Hawaiian Islands. Bishop Mus. Occas. Pap. 48: 23-36.

Medeiros, A.C., L.L. Loope, T. Flynn, S.J. Anderson, L.W. Cuddihy, and K.A. Wilson. 1992. Notes on the status of an invasive Australian tree fern (*Cyathea cooperi*) in Hawaiian rain forests. American Fern Journal 82: 27-33.

Medeiros, A.C., Jr., L.L. Loope, and R.A. Holt. 1986. Status of native flowering plant species on the south slope of Haleakala, East Maui, Hawaii. Coop. Natl. Park Resources Stud. Unit, Hawaii, Techn. Rept. 59:1-230.

Medeiros, A.C. and H. St. John. 1988. *Geranium hanaense* (Geraniaceae), a new species from Maui, Hawaiian Islands. Brittonia 40(2): 214-220.

Robichaux, R., J. Canfield, F. R. Warshauer, L. Perry, M. Bruegmann, and G. Carr. 1998. Adaptive Radiation. Endangered Species Bulletin. November/December.

Scott, J.M., S. Mountainspring, F.L. Ramsey, and C.B. Kepler. 1986. Forest bird communities of the Hawaiian Islands: Their dynamics, ecology, and conservation. Studies in Avian Biology 9: 1-429. Cooper Ornithological Society, Los Angeles.

Smather, G.A. and D.E. Gardner. 1978. Stand analysis of an invading firetree (*Myrica faya* Aiton) population, Hawai`i. Proceeding of the Second Conference on Natural Science, Hawaii Volcanoes National Park, pp. 274-288.

Smith, C.W. 1985. Impact of alien plants on Hawai`i's native biota: *in* Stone, C.P., and J.M. Scott (eds.), Hawai`i's Terrestrial Ecosystems: Preservation and Management. Coop. Natl. Park Resources Stud. Unit, Univ. Hawaii, Honolulu, pp. 180-250.

Stone, C.P. 1985. Alien animals in Hawai`i's native ecosystems: toward controlling the adverse effects of introduced vertebrates: *in* Stone, C.P., and J.M. Scott (eds.), Hawai'i's Terrestrial Ecosystems: Preservation and Management. Coop. Natl. Park Resources Stud. Unit, Univ. Hawaii, Honolulu, pp. 251-297.

Stone, C.P. and L.L. Loope. 1987. Reducing the negative effects of introduced animals on native biotas in Hawaii: what is being done, what needs doing, and the role of national parks. Environmental Conservation 14:245-258.

Tomich, P.Q. 1986. Mammals in Hawai`i: A synopsis and notational bibliography. Bishop Museum Press, Honolulu. 375 pp.

Vitousek, P.M., C.M. D'Antonio, L.L. Loope, M. Rejnanek, and R. Westerbrooks. 1997. Introduced species: a significant component of human-caused global change. New Zealand Journal of Ecology 21(1): 1-16.

Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1999a. Manual of the Flowering Plants of Hawai`i, Bishop Mus. Spec. Publ. 97:a1-1918. University of Hawaii Press and Bishop Museum Press, Honolulu.

Wagner, W.L., M.M. Bruegmann, and J.Q.C. Lau. 1999b. Hawaiian vascular plants at risk: 1999. Bishop Mus. Occas. Pap. 60: 1-58.

Wagner, W.L. and D.R. Herbst. 2003. Electronic supplement to the manual of flowering plants of Hawai‘i, version 3.1. December 12, 2003. Available from the Internet. URL: http://rathbun.si.edu/botany/pacificislandbiodiversity/hawaiianflora/supplement.htm.

Wenkam, R. 1969. Kauai and the Park Country of Hawaii. Sierra Club, San Francisco. 160 pp.

Wood, K.R. and S. Perlman. 1997. Maui 14 plant survey final report. Submitted by National Tropical Botanical Garden, October, 1997.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all 12-month petition findings, additions of species to the candidate list, removal of candidate species, and listing priority changes.

Approve: Acting _____ 11/16/05
Regional Director, Fish and Wildlife Service Date

_____

Concur: _____ August 23, 2006
Director, Fish and Wildlife Service Date

Do not concur: _____ _____
Director, Fish and Wildlife Service Date

Date of annual review: October 4, 2005
Conducted by: Marie M. Bruegmann, Pacific Islands FWO
Plant Recovery Coordinator

Comments:
PIFWO Review

Reviewed by: Christa Russell Date: September 22, 2005
Plant Conservation Program Leader

Gina Shultz Date: October 12, 2005
Assistant Field Supervisor,
Endangered Species

Patrick Leonard Date: October 12, 2005
Field Supervisor